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Editor: J. F. Silbaugh. Managing Editor: J. R. Deatherage. Contributors to this issue: M. S. Peter, E. Evers, C. E. Olsson, J. R. Madison, D. W. Goodman, J. E. Pawlick.

Together

Will it work? Will it pay?

Those two familiar questions need to be answered for each new farm practice we develop through research. The questions themselves bring out the fact that all but our most fundamental studies involve *both* natural science and economics.

It's increasingly important for our natural scientists and our economists to work together to help farmers handle today's difficulties and prepare to meet those of tomorrow.

Research improves physical efficiency through a new technology, and the improvements bring changes to farming. Research must also help farmers adjust to the changes.

Take livestock nutrition, for example. We develop a ration that gives best gain per pound of feed and highest quality product. Is this the best ration to use? That depends on total supplies and prices of livestock and feed, and on each farmer's situation. In the case of a dairy herd, the most profitable ration on a farm with ample supplies of high-quality forage is likely to be quite different from that on a farm where the roughage supply is limited or low in quality.

So we need to develop economic data—along with our physical and biological data—that give farmers the information they need to choose ration combinations that are not only biologically right but also give highest net returns under varying production situations and economic conditions.

Information like this will come only through collaboration between natural scientists and economists, in both planning and conducting research. This will enable us to capture the greater results that come from team effort. Teamwork within the natural sciences is the basis of many agricultural developments; adjustments facing farmers offer similar opportunities for joint work by natural scientists and economists.

We can foster more active cooperation between the two groups by stationing them together, promoting joint operation and encouraging informal discussions and meetings.

Our total job in agricultural research requires the best we can give in imaginative effort. Closer cooperation can increase the sum of our individual contributions.

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NEW SOURCES OF IMMUNITY TO VIRUS X

Potatoes bred for resistance to other diseases unexpectedly prove immune to this one

■ A CROSS BETWEEN potatoes susceptible to virus-X disease has produced some plants immune to the virus.

This unexpected development seems to mean that we should screen breeding selections for all diseases the species is subject to, whether or not the parent plants showed resistance to the diseases. Discovery of the immune plants was made by scientists of USDA and the Iowa Agricultural Experiment Station at Ames.

Breeders usually don't expect to find resistance in breeding selections unless at least one of the parent plants is known to be resistant. It has long been known that a character sometimes can appear in a progeny although the character is not evident in either parent. But this fact has not been widely applied in looking for disease resistance.

It is believed that immunity to virus X is inherited through two complementary genetic factors. In the above case, each of the susceptible parents had only one-half the complement and therefore neither showed immunity to the disease. But some of their progeny inherited both factors and thus acquired immunity.

Geneticist A. E. Kehr, leader of ARS potato studies, and plant pathologist J. C. Horton of the Iowa station developed the virus-X immune potatoes. The plants were discovered through accidental infection of seedlings that had been bred to combine resistance to other potato diseases. Virus X spread from infected plants in the same greenhouse to the seedlings, infecting some heavily and others apparently not at all.

Seedlings resist inoculation

Kehr and Horton made the cross again and deliberately inoculated the resulting seedlings with virus X. Some of the plants went through five inoculations without becoming in-

TURN PAGE

Virus X

(Continued)

fected. The scientists concluded that a percentage of the seedlings obtained from the cross were highly resistant or immune to virus X.

The only other source of immunity to virus X has been seedling S41956, developed 26 years ago by USDA scientists E. S. Schultz, F. J. Stevenson, and W. P. Raleigh. At the time, Stevenson and others suggested that inheritance of immunity to virus X was through complementary genetic factors, but this theory was never tested. The finding of the immune seedlings by Kehr and Horton supports Stevenson's suggestion.

VIRUS-X INFECTED potato leaflets at left are mottled and smaller than uninfected leaflets at right. Some infected plants show no symptoms. Others may have mosaic pattern on leaves or leaves of lighter green than normal.

No immune ancestors revealed

Investigation of the backgrounds of S41956 and the seedlings developed by Kehr and Horton did not reveal that the plants inherited immunity from common sources, nor could any ancestral plant with known resistance or immunity be identified. All ancestors still available were screened and found susceptible.

The seedlings developed by Kehr and Horton provide a new source for incorporating immunity to virus X into potatoes. Virus X disease is present among many varieties, some of which are symptomless carriers.

The disease can reduce yields by 10 to 25 percent. It is easily spread by contact of healthy plants with diseased plants and through agents such as people or equipment. ☆

HOW TEMPERATURE AFFECTS RANGE SEEDING

■ More attention should be paid to temperature at time of seeding in efforts to establish range grasses, USDA research shows. Because of low and erratic rainfall on the range, the main concern in seeding is usually adequate soil moisture. But germinating seeds have temperature as well as moisture requirements. In fact, a recent study of six range grasses showed that, within fairly broad limits, seed germination was reduced more by unfavorable temperature than by low moisture.

ARS range conservationist W. J. McGinnies at the Colorado Agricultural Experiment Station, Fort Collins, made the germination tests, using three temperatures and six levels of moisture stress. Moisture stress—the resistance to movement of water into plants—increases with decreasing water concentration. When soil moisture is low, moisture stress is high.

The tests showed that as moisture stress increased, germination was delayed and reduced. But as long as the temperature was favorable, seeds germinated fairly well even under relatively high levels of moisture stress. The grasses tested, all cool-season species, were Nordan crested wheatgrass, Greenar intermediate wheatgrass, Topar pubescent wheatgrass, Whitmar beardless wheatgrass, Lincoln smooth brome, and Russian wildrye. Under high moisture stress, all six germinated better at a test temperature of 68° F. than at 50° or 86° F. Beardless wheatgrass and Russian wildrye—more difficult to establish under range conditions than the other four grasses—showed the least adaptability to different temperatures and levels of moisture stress.

Range must still be seeded at times when soil moisture is available, but we can direct future research into ways to make the temperature more favorable for germination. For instance, if moisture is available only during warm periods, it may be possible to keep the soil cooler by using a mulch or a tall stubble. When the temperature is too low, planting only on exposures that get the most sun may be the answer. ☆

More N, Less Lime: WASTED FERTILIZER

How does acidity make our soils less productive? With nitrogen use going up, we need answers

■ THE STRONG TREND to heavier nitrogen fertilization, coupled with reduced use of lime over the past decade, is making our soils more acid.

That's why USDA has expanded its research into the problem of acidity.

More than 50 field experiments on 23 agriculturally important soil types are now being conducted in cooperation with State experiment stations to fill in the gaps of our understanding of how acidity decreases yield. These same soils are also studied under uniform environmental conditions in greenhouse and laboratory to learn why they behave as they do.

Although this research is only in its second year, it has already given some interesting leads. For example, alfalfa was grown in the greenhouse on two silt loams that showed the same lime requirement when tested by any of the accepted soil tests. When limed, one soil gave a 400-percent increase in yield but the other gave only a 25-percent increase. Understanding the reason for such differences in behavior among soils would be one of the keys to accurate prediction of lime requirements.

N fertilizers lower pH

Almost all the nitrogen fertilizers used today will severely lower pH. In an experiment some years ago, an unusually high amount of nitrogen (1,200 pounds of ammonium sulfate per acre) lowered pH in 2 years from 7.0 to 3.6 in a clay loam. This causes poor crops and a waste of fertilizer. In another experiment, up to 75 percent of fertilizer nitrogen was reported ineffective as a result of low pH. Liming markedly increased fertilizer utilization.

Toxic concentrations of manganese and aluminum are probably the most common cause of poor plant growth in acid soils. Such effects have been suspected for a long time. But more recently, manganese toxicity has been identified in cotton plants throughout the Southeast and in coffee plants in Puerto Rico, where soil acidity had been increased through use of high nitrogen without lime.

There is no doubt in the scientists' minds that acidity is serious, but there are still questions as to how it causes known reactions:

—Is aluminum or manganese toxicity the more important problem?

—Under what conditions and for which crops and soils are these toxicities of particular significance?

—What are the interactions of nutrients such as phosphorus with toxic levels of aluminum and manganese?

—How and to what extent does organic matter alleviate the toxicity of these elements?

—What are the critical levels of these elements in important crops?

Soil acidity is the most serious soil management problem we face in the Southeast and East and is also serious in the Corn Belt, says ARS soil scientist R. W. Pearson.

Southeast acidity just offset

In some areas of the Southeast, current use of limestone barely compensates for the acidity being created by the nitrogen fertilizers.

From 1947 to 1957, the use of nitrogen fertilizer jumped from less than a million tons to 2.3 million tons a year. But the use of limestone dropped over a third—from 28 million to 18 million tons in 1954—and had only increased back to 22 million by 1958. Some 30 million tons are estimated to be needed annually to maintain optimum soil reaction. ☆

EXTREME SOIL ACIDITY caused barren patch in test plot of cotton in Alabama. No lime was applied for 16 years, while light applications of ammonium nitrogen were used.

Prefab Liner for Irrigation Canals

■ A PREFABRICATED LINER for irrigation canals is under cooperative test near Logan, Utah. The liner, burlap coated with asphalt, appears practical and long lasting.

Efficient canal and reservoir liners are sorely needed in the semiarid West where two-thirds of all irrigation water is lost. Estimates are that a third of the water seeps away during conveyance, and another third is lost in application by runoff and deep percolation.

First installation for testing the new asphalt-burlap material was made last August, under the direction of USDA soil scientist C. W. Lauritzen, in cooperation with the U.S. Bureau of Reclamation, Utah Agricultural Experiment Station, and commercial organizations. Lauritzen expects good results from the new liner, but preliminary information will not be available until the material has been tested a year or more.

The liner was prefabricated by coating each side of 15-ounce burlap with asphalt, producing a thickness of about $\frac{3}{8}$ inch. The burlap was chemically treated to inhibit rotting. Sheets of the asphalt-burlap were laid directly on the soil in the canal. Joints were sealed by briefly applying the flame from a liquid-petroleum gas torch to soften the material's edges, which were then overlapped and pressed together.

A thin layer of clay, sprayed like paint, is the only cover being used over the otherwise exposed material. This treatment slows deterioration of the asphalt.

Exposed liners require only half as much excavation as buried liners and can be easily inspected and repaired. However, buried asphalt liners, built in place in earlier experiments, have given long service.

PREFAB LINER, burlap coated on each side with asphalt, seems practical and long lasting. C. W. Lauritzen demonstrates use of gas torch to seal edges of experimental irrigation canal liner.

Lauritzen says the asphalt-burlap lining is expected to cost about $1 a square yard. This could be lower than for concrete linings, because gravel aggregate needed to make concrete must be shipped long distances to many Western and Plains States.

The ARS scientist has been working on irrigation canal and reservoir liners for several years. Materials tested include natural earth, plastic, concrete, cold asphalt, and hot asphalt applied in place and reinforced with burlap and other fabrics. Some of the developments have now become accepted practices. ☆

SUBSOILING DIDN'T PAY HERE

■ SUBSOILING OF FIELDS before plowing won't increase corn yields in the Prairie soils of the Corn Belt.

That is the conclusion of scientists from tests run cooperatively by USDA and the Iowa and Illinois Agricultural Experiment Stations.

Many had thought that heavy modern machinery was compacting soils and cutting yields, and that subsoiling would therefore benefit crops. Although earlier findings showed little benefit from this practice, subsoiling tests were set up as a further check in Iowa and Illinois. Also, in some of the Iowa experiments, superphosphate was placed deep in the channel to see if that would help.

In the Illinois research, yields were increased significantly in only one out of eight experiments in 1955, and the residual effect increased yield in one out of six in 1956.

The 12 Iowa experiments, conducted from 1955 to 1958, showed no increase in yield. In fact, subsoiling to a depth of 24 inches *de*creased corn yields significantly in 2 of the tests. The 12 tests were conducted on 7 different soil types at a depth of 16 to 24 inches. Superphosphate was found to be less effective when placed deep in the subsoiled channel than

when it was plowed under in the conventional manner.

The scientists say it may be possible to tell beforehand if subsoiling will prove helpful. In areas where subsoiling has been effective, compacted zones in the soil layer have been observed, along with considerable root restriction. No such characteristics were noticeable in the Illinois-Iowa experiments.

In Iowa, all the fields but one were subsoiled in the fall, all were plowed in the spring, and all but one were conventionally prepared. On some fields, the treatment was repeated the next year; in others, residual effect was studied. Soils were all silt loams: Ida, Marshall, Galva, Webster and Glencoe, Edina, and Grundy. Subsoiling to a 24-inch depth cut corn yield 9.7 bushels per acre on Edina soil in 1956 and 6.3 bushels on Grundy soil in 1954. Although not statistically significant, the trend in several other tests was toward lower yields from subsoiling.

The Illinois fields were subsoiled at 10 to 12 or 16 to 18 inches in the fall and plowed a few weeks later. Soils were Ashkum and Drummer silty clay loams and Elliott, Martinton, and Symerton silt loams. ☆

PLASTIC DRAINS WORK IN WEST

■ MOLE DRAINS LINED with low-cost vinyl plastic are efficiently draining unused water and crop-damaging salt from irrigated test plots in USDA-State-industry experiments in the West. Similar drains have performed well in the East for 2 years without cave-ins, filling, or blockage (AGR. RES., January 1959, p. 10).

Preliminary findings point to plastic as less expensive than conventional tile for Western farmers and ranchers to use in removing the water and salt from fields. The drains could be installed in any area without disrupting normal farm operations.

In one experiment near Logan, Utah, the outflow from each of 5 plastic-lined mole drains, 300 feet long, 22 inches deep, and 3 inches in diameter, is about 2½ gallons of water a minute. The drains also are removing 117 pounds of salt a day from the plot of almost 1½ acres. Water drained from the test area contains 10 times as much salt as water applied. The experiment is being conducted by ARS agricultural engineer L. S. Willardson. Use of the plastic liner is also being studied cooperatively by the California, Nevada, and Colorado Agricultural Experiment Stations.

Plastic-lined drains in the Utah experiment are up to 400 feet long and spaced 20, 30, and 40 feet apart. All are 22 inches deep. Using heavier equipment, the plastic could be installed as deep as 42 inches.

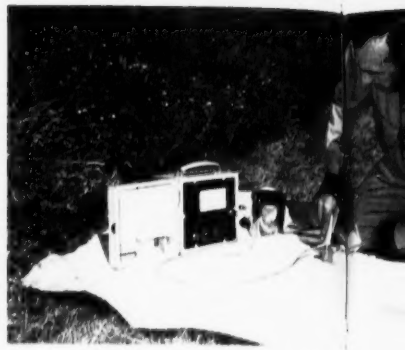
Plastic for the Western tests is slightly different in construction from material used in the East. On each side of the drain bottom is a row of small holes spaced ¾ inch apart, connected by 1½-inch cross-wise slits. This permits water to enter and the semibrittle plastic to bend without breaking. During installation, the even-edged plastic is overlapped at the top with no seal. In the Eastern studies, edges of the plastic were slit at intervals to avoid stress.

Cost of the 15-mil plastic used in the tests was placed at less than 10 cents a foot. Costs of installing the plastic drain also are low, because it is not necessary to dig and refill large ditches.

The plastic linings are installed in one continuous operation by a special device that was developed and loaned by an industry cooperator. As a crawler-type tractor pulls the equipment forward, a slit is made in the soil to the desired depth by a subsoil blade. The laying device removes the 11-inch-wide plastic from a roll and forms the material into a plastic drain in the soil. No backfilling is done, since the soil itself closes the slit after installation. ☆

ABOUT 117 POUNDS of salt a day are drained off by plastic moles, reports L. S. Willardson. Here he checks water outflow of about 2½ gallons per minute from plot of nearly 1½ acres.

1. Plastic unrolls as crop is cut and windrowed. Crop is combined on plastic and shattered seed gathered up, reducing loss 35 percent.



2. Meter, shown by L. M. Klein, measures moisture content of crop, could be used by farmers for determining best time to harvest grasses, legumes.

5. Modified-indent cylinder, vacuum system enable difficult separation of alfalfa and pigweed seeds, could bring great savings.

BETTER WAYS TO HANDLE SEED

Agricultural engineers are improving machines and methods for the multimillion dollar small-seed industry

■ IMPROVED EQUIPMENT and techniques under development for handling grass and legume seed are expected to greatly reduce losses running as high as 50 percent.

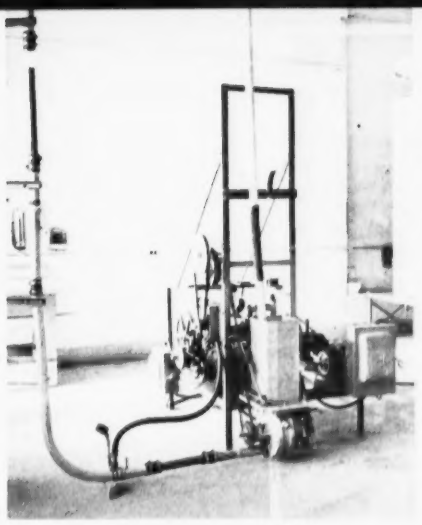
USDA agricultural engineers, headed by J. E. Harmond, are recovering much of the seed that's usually lost because of field shattering, processing damage, and weed contamination. The research is conducted in a seed laboratory operated cooperatively by ARS and the Oregon Agricultural Experiment Station at Corvallis.

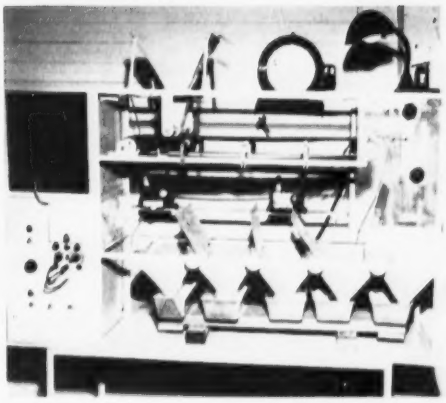
Here are some of the experimental developments that are expected to save much of the $200 million worth of grass and legume seed produced in the U.S. and $15 million more imported each year:

1. A 35-percent reduction in shatter losses of birdsfoot trefoil by combining in windrows on wide sheets of plastic. Shattered seeds are gathered up, and the plastic is rerolled during combining. Similar savings result if trefoil is cut before shattering starts, cured in loose bales or shocks, then combined.

2. A moisture meter for use by farmers to indicate when grass and legume crops are prime for harvest.

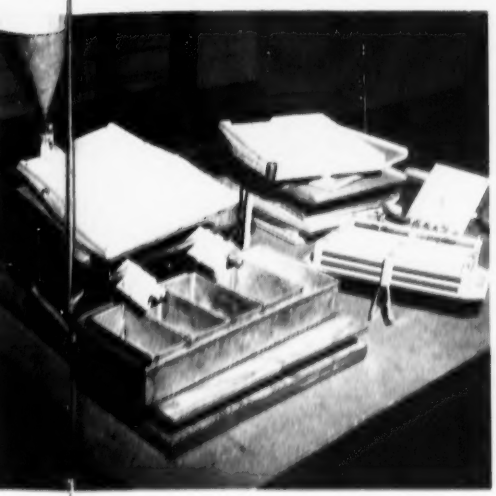
3. A "fluidized" conveyor, for use in seed-processing plants, designed to move seed pneumatically at low velocity. It conveys up to 3,000 pounds of seed an hour



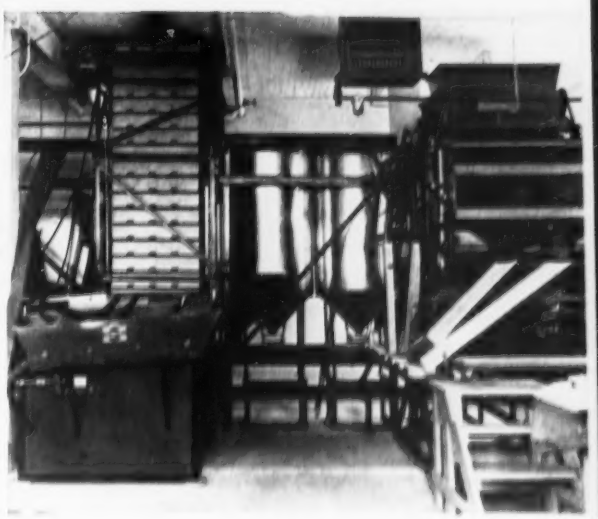


4. Electrostatic device holds seed on belt by means of electric charge. Different seeds, depending on ability to hold charge, drop into containers.

3. Fluidized conveyor moves up to 3,000 pounds of seed per hour. Seed is moved pneumatically at low speed.



7. Single-story plant could replace inefficient cleaning plants that are several stories high, costly to operate and maintain.



6. Automatic device enables separations that were not possible. Vibrating table is adjusted so different seeds form in paths, drop into small containers.

through 1½-inch pipe, avoiding the usual damage by conventional pneumatic systems.

4. A precision electrostatic device that enables additional separations. Different seeds drop from a conveyor belt into appropriate containers, depending on ability of the seeds to hold an electrical charge.

5. A combination modified-indent cylinder and vacuum system that effectively separates alfalfa and tiny pigweed seeds. The pigweed seeds drop into indents inside a revolving cylinder and are sucked away through a flexible pipe. Pigweed contamination now costs the seed industry millions of dollars a year.

6. An automatic seed separator, consisting of a vibrating table, 8 by 10 inches, to enable separations that were heretofore impossible. The table is adjusted in any direction to make use of differences in seed shape, surface texture, and weight. As the table vibrates, different seeds form in paths and drop into various containers. Several hundred such units could be energized by one power source to vastly increase capacity.

7. An experimental one-story farm seed-cleaning plant to continuously separate seed by size, surface texture, length, specific gravity, and other characteristics. Reduced labor and maintenance costs are possible, and seed can be run through one or a combination of machines. The new plant could help farmers meet ever-tighter requirements for purer seed and less processing damage. Conventional plants often are several stories high, making operation and maintenance costly.

Other promising equipment not pictured includes: A six-row plot planter, adapted to a push-type tractor, that accurately and quickly plants single seeds and applies fertilizer at predetermined rates. A seed-metering device, called a vibrator-feeder, for use in seed laboratories. This device could facilitate several operations—such as inspecting or counting—involving any size seed from minute bent grass to large beans. Research is continuing on these and other machines. ☆

THE BELT THAT CLEANS COTTON SEED

Adaptable new unit works quickly, efficiently, and is at home in oil and ginning operations

■ THE COTTONSEED cleaning-belt unit—developed originally to help a large and complex machine clean cottonseed—has now graduated to do the job itself with honors.

This should result in higher quality linters—commercially important short fibers left on the seed after ginning. Linters are widely used in bedding, rayon, car seats, writing paper, even sausage casings.

USDA tests show the new unit should be readily adaptable to oil mill and gin operations.

The cleaning belt is an outgrowth of continuing ARS work to improve the efficiency of cotton production through mechanization. While mechanization has certainly speeded up picking and processing, it has also resulted in trashier cottonseed and greater difficulty in separating trash from seed in oil mills.

Our scientists met this difficulty by developing an experimental machine—the ARS differentiator—to remove the bulk of the foreign material and to sort cottonseed according to quality (AGR. RES., March 1957, p. 16). The cleaning-belt unit was developed first as an aid to the differentiator until later tests showed the unit could be used alone.

Rubber surface is textured

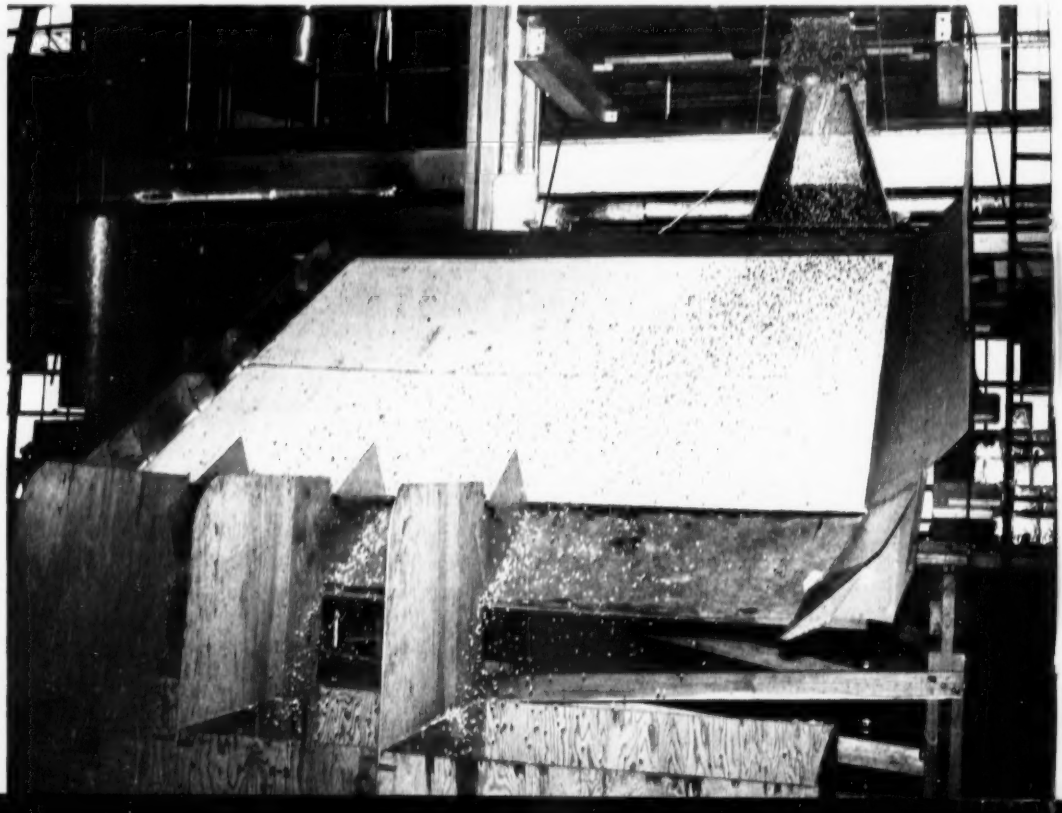
Main operating part is an 8-foot-wide, inclined, horizontally moving belt with a textured rubber surface, mounted on 2 pulleys 10 feet apart. The belt can be operated at speeds from about 150 to 350 feet per minute, and the angle can be adjusted.

A regulation feeder above the belt passes a thin layer of cottonseed down an inclined metal chute, to a narrow opening next to a rotor. Operating at 600 to 900 revolutions per minute, the rotor further disperses the seeds and kicks them downwards to a rubber bouncing board, from which they land onto the moving belt.

Seeds livelier than waste

The cottonseeds have a livelier motion on the belt than most of the foreign matter. The seeds roll and bounce more rapidly and thus land in the accept bins at the lower edge of the belt. But the foreign particles tend to slow down or stall out and are carried along into the reject bins on the far side of the belt.

In recent tests at the Southern utilization division, New Orleans, the unit was used to test-clean seed obtained at three stages: (1) before the



SEEDS BOUNCE and roll down the cottonseed cleaning belt unit, moving from right to left. Belt—of three-ply endless construction—may be operated at horizontal speeds varying from 150 to 350 feet per minute. Regulation feeder above upper right-hand edge of belt passes thin layer of seed down inclined metal chute, to narrow opening next to the rough-textured rubber-covered rotor, 8 inches in diameter. Running 600 to 900 revolutions per minute, rotor kicks seeds down to rubber-covered bouncing board, from which they land onto moving belt. Lively seeds bounce into bins below feeder. Trash particles slow down or cling to belt, are carried to reject bins at left. Feed may be varied from 5 to 75 or more tons per 24 hours.

usual pneumatic cleaning at the oil mill, (2) after the usual cleaning at the oil mill and before first-cut delintering (first removal of cottonseed fuzz or linters), and (3) after first-cut delintering.

The cleaning belt removed 34 percent of the stems and 56 percent of the foreign matter from cottonseed that had not passed through the usual cleaning. In tests on cottonseed that had been cleaned, the unit removed 77 percent of the stems and 44 percent of the foreign matter.

Although it promises to be quite effective in gin operation, first thoughts are for installation in oil mills. The most likely place would be at some point in the usual sequence of preparation—probably after pneumatic mechanical cleaning and before first-cut delintering. The engineers believe this location should make possible production of cleaner first-cut and second-cut linters.

In this location, it would also be possible to recover seed values from reject fractions by further processing and by passing this fraction to the hullers. Such a reject fraction could probably be kept to about 5 percent of the total and, with some reprocessing, might be much smaller.

Current equipment needed

It seems likely, however, that the presently used boll reels, shaker screens, and pneumatic mechanical cleaners or some combination or modification of them must still be used to the limit of their ability to remove large trash, stones, bottles, tramp iron, and field trash.

The cleaning belt's efficiency may be increased still more through a combination of improvements—an optimum combination of belt speed, belt angle, and feed rate; a new feeder-opener; and a belt with better texture. The Southern laboratory is investigating these possibilities. ☆

NEEDED: Guides to Lumber Quality

■ WHAT IS "QUALITY" in lumber? And how can foresters and lumber men judge its value in a standing tree? The USDA Forest Service is searching for answers to these questions through six interregional studies to develop basic information on timber quality and standards for measuring it in major commercial species.

Adequate log and tree grading systems are lacking at present and each forester and timber user may have a different definition of quality. But all agree on the need for uniform standards and definitions when appraising trees and logs for sale and when judging how well the wood will meet users' needs. Standards will also help farmers decide which trees to let grow and which to cut because they lack potential. Breeders will find them useful in selecting superior trees.

The first investigation to get underway is the Ponderosa Pine Project at USDA's California Forest and Range Experiment Station in Berkeley under the leadership of forester C. A. Newport. The study includes sugar pine, white pine, Jeffrey pine, white fir, lodgepole pine, and Engelman spruce. It is utilizing technical personnel of all forest experiment stations and regional offices in the West and the Forest Products Laboratory, Madison, Wis. Also participating are the lumber industry, forestry schools, and other organizations.

The foresters started by analyzing data already collected at some 50 sawmills throughout the West on about 40,000 logs. Quality of these logs was expressed in money value and in yields of commercial lumber grades. The logs were regraded by different methods in current use. The actual measured yield and quality of lumber cut from the logs gave a base for comparing effectiveness of the several systems.

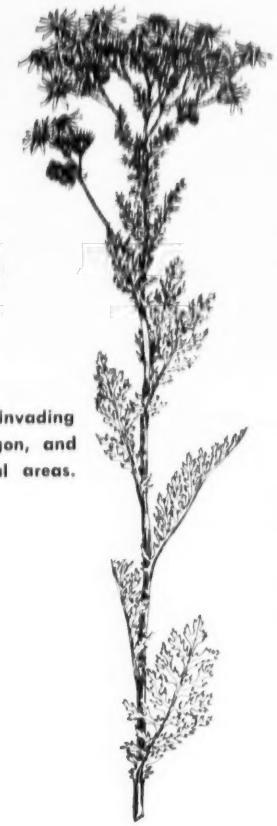
The influence of sawmill and other utilization practices on log quality is also being evaluated.

Mathematical computations and statistical analyses are carried out on electronic computers, using latest methods.

From the data, the foresters are working out the best combination of log and tree quality characteristics—such as diameter, straightness, branchiness, size and distribution of knots, amount of rot, and presence of injuries. This information will be presented as a tentative log-grading system and subjected to practical field tests on standing trees and cut logs. The result should be a useful set of log and tree grade specifications that can be used on ponderosa pine and in later studies of other species and other end products.

This long-term national effort will also include coordinated investigations of Douglas fir (headquartered at Portland, Oreg.), southern softwood (at Asheville, N.C.), northern softwood (at Upper Darby, Pa.), and all hardwoods (at Columbus, Ohio). In addition, exploratory research already underway at the Forest Products Laboratory is being continued to develop basic timber-quality information by radically new methods and concepts. ☆

PUPAE of cinnabar moth were packed in France and shipped to U.S. by H. L. Parker. Insect is aiding in tansy ragwort control.



TANSY RAGWORT is invading California, Oregon, and Washington coastal areas.

Insect on Our Side

Imported cinnabar moth larvae eat toxic weed but bypass useful plants

■ An insect attack against tansy ragwort—toxic weed invader in the coastal areas of California, Oregon, and Washington—has been launched by USDA-State researchers.

The insect is the cinnabar moth (*Tyria jacobaeae*), a natural enemy of this biennial weed in Europe and Great Britain, according to J. K. Holloway, ARS specialist in biological control. Holloway and entomologist C. B. Huffaker, of the California Agricultural Experiment Station, are cooperating in this effort.

Proof that the insect has no liking for any useful plants has been established in feeding trials at the ARS Parasite Introduction Laboratory, Paris, France, by entomologist H. L. Parker. He collected the moths, raised larvae in confinement to insure freedom from parasites, tested them on many plants to guarantee that they are specific to tansy ragwort, and sent about 6,000 parasite-free larvae to Albany, Calif. The insects were released in June 1959, getting the attack underway.

Weed's relatives not attacked

Originally scheduled for completion in 1957, the trials were extended to include feeding tests with safflower, a relative of tansy ragwort, now grown in California as an oilseed crop. The tests proved that the moth could not reproduce on safflower or any other plants previously tested.

Tansy ragwort is more toxic to horses than cattle. Sheep frequently eat the weed without being poisoned. The weed is aggressive, due in part to lack of natural competition, and is spreading over more land each year. Chemicals control it, but areas of infestation are so great, and in many cases so inaccessible, that spraying is economically unfeasible.

Importation of the natural enemy should offset the weed's spread and bring eventual control. Put into fields heavily infested with the weed, the orange and black ringed larvae took at once to the plants and began to feed upon them voraciously.

Larvae feed on foliage, buds

Normally, the larvae pupate in the soil at the base of the plants during the midsummer. The adults emerge in the early spring and the females lay their eggs on the underside of the tansy ragwort leaves. Larvae emerge from the eggs to feed on the foliage and young buds of the plant before dropping to the ground to continue their life cycle. Continued seasonal defoliation destroys the seed heads and greatly depletes the plant's food reserve, usually resulting in destruction of the weed.

It's hoped that the moth responds to the climate in the release area and emerges next spring at the time the plants are starting to form flower buds, as it does in its native land. If range grasses then grow into the areas cleared of tansy ragwort fast enough to keep the weed seeds from reinfesting the land, the control effort will be a success.

As in the case of the Klamath beetle introduced to control Klamath weed, this form of control will not completely eliminate tansy ragwort. It should, however, keep the weed controlled to the point where it no longer causes economic stress. ☆

CARCASSES BETTER, GAINS SLOWER

■ CARCASS QUALITY OF HOGS can be improved by feeding more alfalfa as well as by maintaining higher protein levels in finishing rations, USDA scientists report. But they find that more time and feed are needed to produce a market hog when extra alfalfa is used.

Two series of experiments were conducted by ARS at the Agricultural Research Center, Beltsville, Md. Researchers studied the effects of adding 16 or 28 percent dehydrated alfalfa meal to the rations of swine weighing 100, 125, and 150 pounds, and the effects of reducing protein levels during finishing in feedlots.

Carcass backfat, bacon thickness, and the percentage of total fat were significantly reduced by feeding extra alfalfa to hogs of all weights tested.

Progressive decreases in rate of gain and feed use efficiency took place at all weights, however, where the alfalfa content of the diet was increased from 4 to 16 or 28 percent. Rate of gain dropped from 1.65 pounds per day with 4 percent alfalfa to 1.55 and 1.40 pounds per day as the alfalfa content increased. At the same time, in hogs of 100 and 125 pounds live weight, it took more feed (4.12 pounds compared with 4.22 and 4.59 pounds) to produce a pound of gain as the alfalfa content rose. Adding extra alfalfa in the diet of the 150-pound hogs improved carcass grade and increased carcass length but produced only slight effects on rate of gain and feed efficiency.

Protein level, in the other experiment, caused no changes in rate of gain or feed efficiency. The higher protein level did reduce the percentage of carcass fat and increased the percentage of preferred cuts of meat. In this test, the protein level of one lot of pigs was reduced from 18 to 15 percent when the pigs reached 125 pounds, and another group of hogs had the protein level of their diet reduced from 14 to 11 percent.

Half the pigs in the protein study were fed chlortetracycline. This gave significant effects—reduction of backfat from 1.77 to 1.61 inches—only on pigs receiving the antibiotic during the first half of the experiment. ☆

COOKING BEEF NEW WAYS

■ NEW METHODS OF COOKING beef are coming out of cooperative research being conducted by the USDA Institute of Home Economics and seven universities and State agricultural experiment stations.

It has been customary to roast or broil only rib and loin cuts and to braise (cook in a covered pan with or without added water) other cuts.

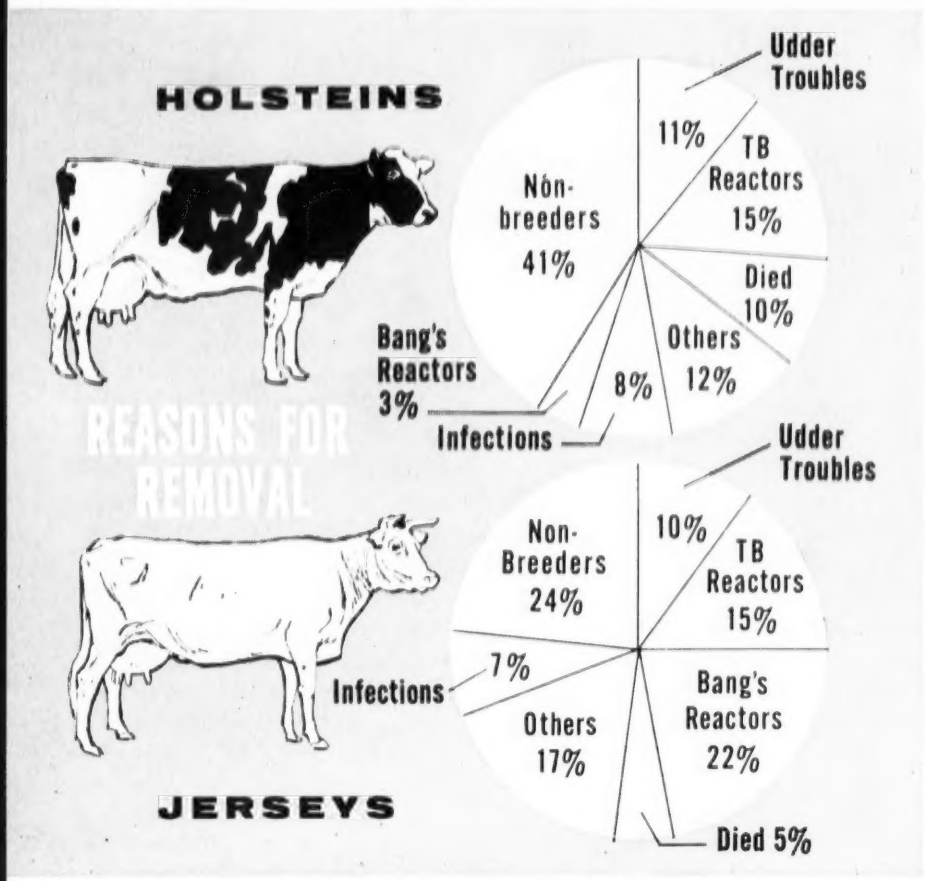
Now ARS food specialist Elsie H. Dawson, who summarized the research data, finds that cuts such as chuck and round from young lean animals can be roasted or broiled. They have almost the same good eating quality as similar cuts of meat from fatter animals cooked in the same way. Roasted beef round or shoulder cuts scored just as high or higher in tenderness and flavor as matching cuts cooked by moist methods to the same temperature of doneness, or roasted to a lower temperature than is generally used for braising.

More ways to cook these cuts will add variety to menus and help consumers make better use of lean meat—of interest to those who want to reduce dietary fat intake and obtain more meat for money spent.

The degree of doneness (indicated by internal temperature at the end of cooking) affects palatability, the researchers found. Generally, meats cooked to rare or medium doneness (140° to 150° F.) are more tender, juicy, and flavorful than those cooked to well done (130° F.). This is true whether the meat is braised, broiled, or roasted. Higher internal temperatures increase the amount of moisture and fat lost during cooking, leaving meat less juicy. Overheating also decreases tenderness because protein toughens with heat.

As cooking continues, however, another change takes place. The collagen in the connective tissues changes to gelatin, the tissues become softer, and there are some changes in flavor and texture of meat. When meat is high in connective tissue, or when well-done meat is desired, the cut should be braised in a slow oven for a long period, stewed, or pressure cooked. ☆

WHY COWS LEAVE HOME



Evaluation of long-time Beltsville records shows little to gain from deliberate selection for long life

■ AT WHAT AGE does a cow leave home? As a rule, at about 6 years when she stops producing or breeding, unless she dies first of disease, infection, broken bones, or from eating a few too many nuts and bolts.

Would it be profitable to concentrate on efforts to lengthen a cow's life? Some think it may have possibilities for improving the herd. A longer life would theoretically mean more calves and more milk.

But a study of 40-year herd records at USDA's Agricultural Research Center, Beltsville, Md., shows that *automatic* selection for long life—incidental to selection for high production and other qualities—is already so intense that it would be practically impossible to exceed it by deliberate effort. Moreover, the heritability of long life appears to be so low that the effectiveness of deliberate selection for this trait is questionable anyway.

Longevity influences studied

The evaluations were made by ARS dairy husbandman J. B. Parker and associates to determine environmental and genetic influences on long life in nearly 1,000 Holstein and Jersey cattle. None of the herds had ever been culled for low production or poor type during the 40 years.

Reasons for disposing of cows are important in judging overall herd longevity. Evaluation of the Beltsville herd disposal records showed cows were removed for various diseases, infections, and udder troubles. A large number, however, were removed as nonbreeders—41 percent of the Holsteins and 24 percent of the Jerseys. This indicates the importance of nonbreeding as an influence on life expectancy.

The large percentage of nonbreeders removed may have resulted because more detailed disposal records are kept in the Beltsville herds than are made in most Dairy Herd Improvement Association herds. The Beltsville data may reflect more accurately the importance of poor reproduction as an influence on longevity than DHIA information.

High producers tend to last

A positive relationship—low but significant—was found between long life and first-lactation production in both Holstein and Jersey herds. This suggests that cows that are high producers in their first lactation don't "burn out" or stay in the herd for a shorter time than other cows. In fact, the data indicate that the higher producers tend to stay in the herd longer than low producers even when no selection is practiced for production. This finding should be of special significance to sire-selection committees when they evaluate progeny tests that are based primarily on first-lactation records.

These evaluations don't detract from the importance of bringing about longer life through improved management, say the scientists. Disease and injury prevention practices and proper feeding and management *can* bring longer life and improve efficiency of herd operations. ☆

New red oat

Curt, a new short-strawed red oat variety adapted to hay, pasture, and grain production in California and perhaps other red oat areas, has several desirable characteristics.

Although only about 60 percent as tall as other varieties, Curt about equals hay production of taller plants and yields some 25 percent more grain. It is resistant to lodging and shattering, and yellow-dwarf and stem rust diseases. Curt's growth habits enable it to respond more favorably to high fertility and irrigation than other oat varieties.

Curt was produced by agronomist C. A. Suneson of ARS and cooperators at the California Agricultural Experiment Station, Davis.

One parent is Kanota, a widely grown red oat. The other parent is a rare, genetically defective (nullisomic) red oat that possesses several desirable characteristics.

Limited amounts of seed should be available for general planting next season, and growers of certified seed are increasing supplies. Seed is not available from either USDA or the California Station.

For better wool fabrics

USDA's new $105,000 Wool Processing Laboratory at Albany, Calif., houses the main ARS effort to develop better wool fabrics.

Studies conducted at the laboratory, a unit of the Western Utilization Research and Development Division, will be aimed at improving wool's properties and competitive position.

Studies are planned on chemical treatments to improve desirable properties of wool and mohair—such as greater resistance to wear and soiling without sacrificing natural texture, soft drape, and flame resistance. Included is research to impart "easy-care" qualities to all-wool fabrics.

The laboratory building has 18,000 square feet of floor space and contains equipment for processing experimental lots of domestic wool on the American worsted system—from raw wool to finished fabrics.

Mineral content varies

Certain fresh vegetables vary greatly, from one part of the country to another, in sodium and manganese content, a USDA study shows.

But chemist H. T. Hopkins and statistician J. Eisen of the ARS Human Nutrition Research Division found less difference in iron, copper, and calcium values and very little difference in boron, phosphorus, aluminum, magnesium, and potassium values from area to area.

Asparagus, snap beans, cabbage, carrots, celery, sweet corn, lettuce, onions, and tomatoes were purchased for the studies on the Washington, D.C., wholesale market and analyzed spectroscopically. These vegetables were selected because a survey showed they were consumed in U.S. households in greater amounts than other vegetables except potatoes.

The sodium content of lettuce grown in California was about 10 times that of lettuce grown in New York. Western onions, carrots, and celery were also higher in this element than Eastern-grown vegetables. This may be due to the higher sodium content of irrigation water and soils in Western areas. However, lettuce and onions, even at the highest levels of sodium, contribute little of it to diets in comparison with that from other sources. Carrots and celery are high in sodium, each containing 5 to 10 times as much as the other vegetables, regardless of source.

Arizona and southern California carrots had two to three times as much manganese as those from central California, New Mexico, and New Jersey. Southern Texas carrots averaged four to five times as much.

Half-way point

Advances made since 1954 in combatting brucellosis point to eradication of the costly cattle disease that causes undulant fever in man.

In just 5 years, 24 States, Puerto Rico, and the Virgin Islands qualified

NEW LABORATORY at Albany, Calif., houses main ARS effort to develop better wool fabrics.

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as modified-certified brucellosis areas in an all-out effort to eliminate the disease. A campaign by ARS and the States cut the nationwide infection rate in half since 1954. A new method used by States to maintain qualification is aiding (AGR. RES., May 1959, p. 8).

Nine States qualified in 1959—Arizona, Georgia, Maryland, Massachusetts, Nevada, New York, Oregon, Tennessee, and West Virginia. Connecticut, Delaware, Maine, Michigan, Minnesota, New Hampshire, New Mexico, New Jersey, North Carolina, Pennsylvania, Rhode Island, Utah, Vermont, Washington, Wisconsin, Puerto Rico, and the Virgin Islands were certified earlier. At least 1,769 counties out of a total of 3,152 in the U.S., Puerto Rico, and the Virgin Islands are certified.

A State or area qualifies for certification when not more than 1 percent of its cattle nor more than 5 percent of its herds are infected with the disease.

Aids for blight control

Two recent research developments may help control bacterial blight of cotton before the disease gets completely out of hand. USDA plant pathologist W. C. Schnathorst and coworkers at the California Agricultural Experiment Station, Davis, isolated and determined the race of the disease-causing organism. This facilitates breeding of resistant varieties. The scientists also found an organic phosphate useful in controlling the disease in the field.

Both findings are being exploited because the disease has been rapidly spreading throughout California's San Joaquin Valley during the past few years. Increased use of sprinkler irrigation seems to be directly associated with spread and severity of the disease.

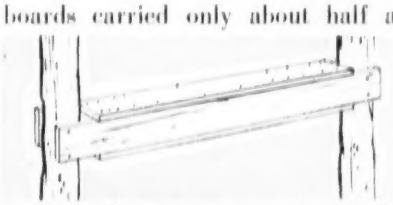
Its spread through contaminated seed has been attributed to handling at gins of cotton from sprinkler-irrigated land. Therefore, only cotton grown under furrow irrigation is now used to produce planting seed. Research is aimed at various forms of sanitation and treatment to kill bacteria contaminating the seed.

"Beams" strengthen walls

Boxing-in of nailing girts creates "beams" that add strength to grain storage or other building walls put under heavy pressure.

D. V. Doyle of USDA's Forest Service discovered this while doing research for ARS engineers who needed extra strength in a pole-type grain-drying building being designed.

Girts boxed-in with 1-inch covering boards carried only about half as



much load as girts covered with 3/8-inch plywood. Concentrating the nails near the ends of covering boards increased strength and stiffness of the beams, compared to those with uniform nail spacing.

Studies at new labs

Experiments are underway at the two new soil and water conservation research laboratories of USDA.

Studies of soil and water conditions characteristic of semiarid western Minnesota and adjacent States are being made at the North-Central Conservation Field Station, Morris, Minn. Researchers of the Southwest Water Conservation Laboratory at Tempe, Ariz., are seeking ways to conserve water in the arid Southwest.

Research at the North-Central Station, serving Minnesota, Iowa, and the Dakotas, includes studies of soil moisture management, cropland drainage, and improved economical tillage principles. Information also is being developed on water intake rates, water storage capacities of soil, and runoff rates.

The Tempe laboratory houses the world's three electronic lysimeters for measuring percolation of water in soil. These devices can detect and record, at 15-minute intervals, weight gains or losses equivalent to less than 0.001 inch of moisture. Located near the Cotton Research Center of the University of Arizona, the laboratory serves Arizona, Utah, Nevada, and New Mexico.

Each of these new ARS installations cost about $550,000. They were dedicated last October.

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